MCI Telecommunications Corporation

1801 Pennsylvania Avenue, NW
Washington, DC 20006

EX PARTE

September 30, 1997

William F. Caton
Acting Secretary
Federal Communications Commission
Washington, D.C. 20554

Re: Ex Parte Submission
Federal-State Joint Board on Universal Service; CC Docket No. 96-45
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs; CC Docket No. 97-160

Dear Mr. Caton:

At the request of Universal Service Division staff, AT&T and MCI are submitting the attached data regarding tentative customer location and outside plant results for six wire centers - Gunnison and Hayden, Colorado, Vernon and Albany, Texas; and Duluth and Waynesboro, Georgia. Included are a discussion of issues associated with assigning customers to wire centers and a display of wire center boundaries, a desciption of how total lines in each census block were calculated, a description of the MetroMail data and the geoccoding process, along with a description of the methodology used to determine customer locations for customers not in the MetroMail data, the source code and a licensing agreement for the clustering algorithm, a display of final customer locations and the characteristics of the clusters and outliers within wire centers, a description of the methodology of the Distribution and Feeder modules, and a display of loop-length and loop investment statistics along with a comparison of these statistics with the equivalent statistics from Hatfield 4.0.

Respectfully submitted,

Chris Frentrup

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Association of Customers to Wire Centers

To model accurately the costs of the loop plant emanating outward from a wire center, it is vital to determine accurately the set of customers who are served by each wire center. Two general approaches may be followed: geographic and/or logical.

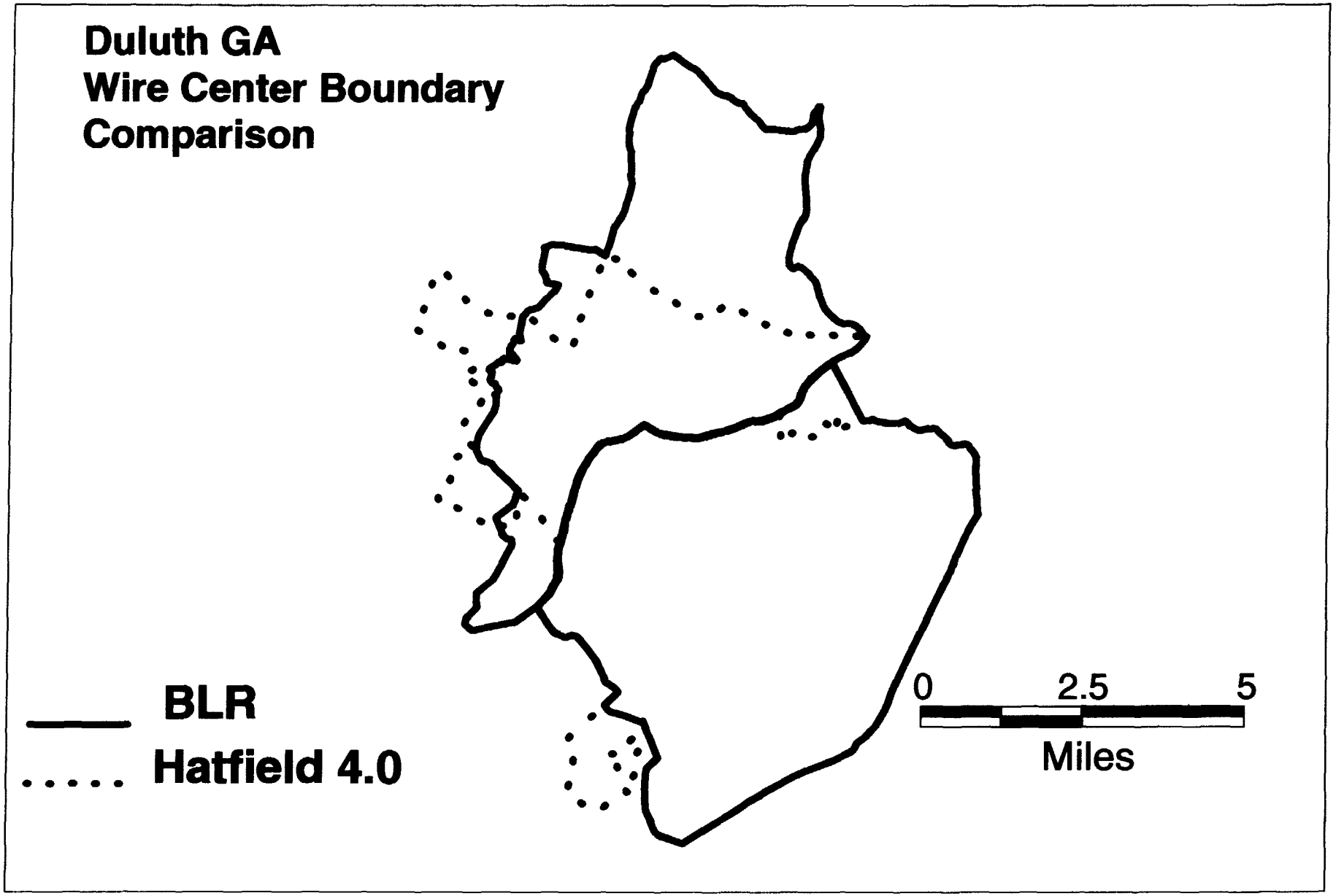
Earlier versions of the Hatfield Model (releases 2.1 and 2.2), used a geographic approach. Geographies (which were CBGs), were assumed to be served by the closest wire center in radial distance. This could have the result of some customers or geographies being assigned to wire centers, or to telcos, that did not actually serve them.

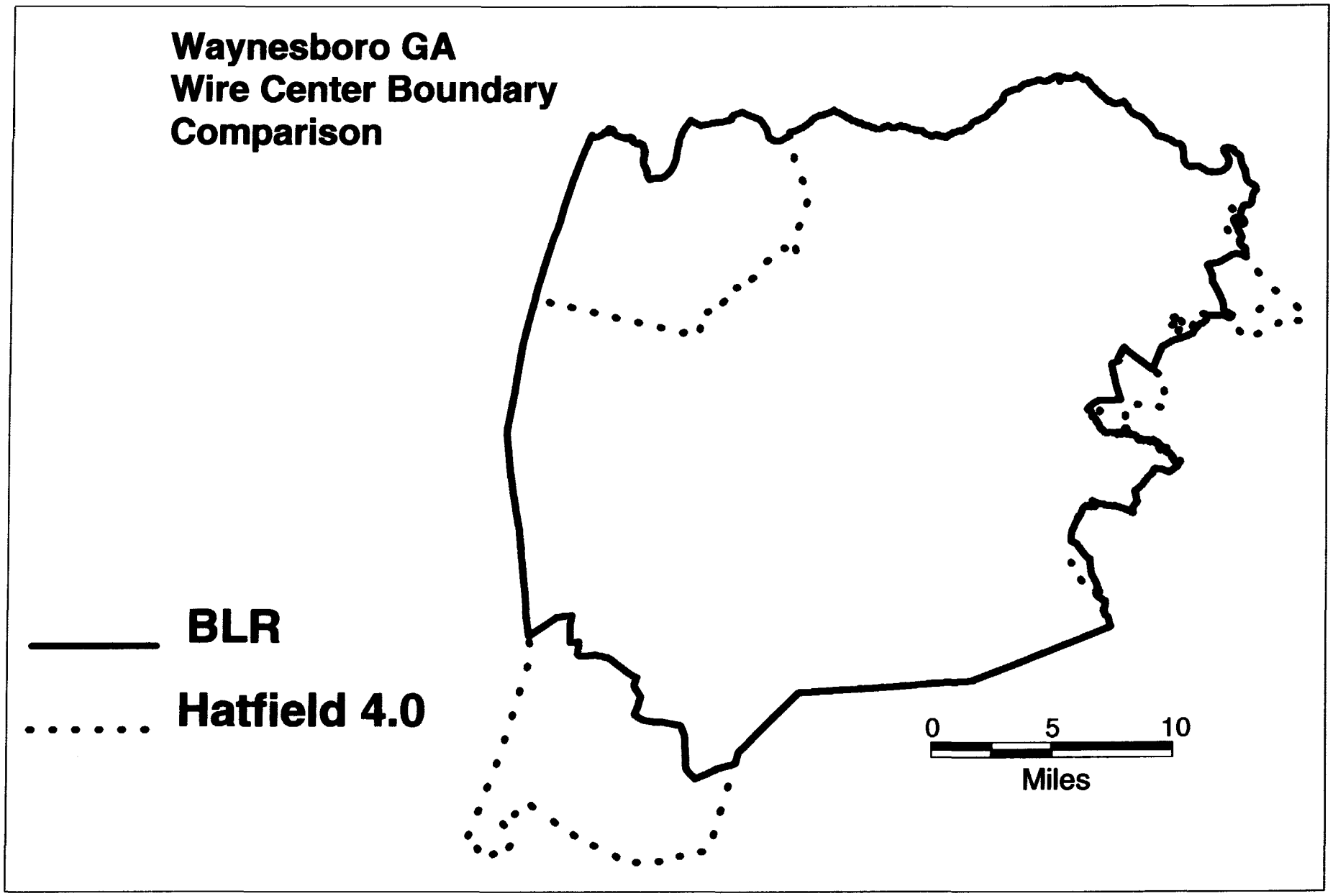
Releases 3.0, 3.1 and 4.0 of the Hatfield Model used a logical approach that improved greatly upon the earlier geographical "closest distance" approach. Under this methodology, the actual NPA-NXXs of the telephone lines located in a CBG were examined to determine the identity of the wire center serving the most telephone lines in the CBG. This methodology eliminated the possibility that a CBG would be assigned to a wire center that did not actually provide significant service to that CBG. However, it remained possible that if more than one wire center actually served the CBG, some customers in the CBG would be assigned to a wire center that did not actually serve them.

The upcoming release of the Hatfield Model will perform its analysis on a customer cluster level, thus, it must determine the wire center serving each cluster. To do this, it will use a combination of logical (NPA-NXX) and geographical (CB) mapping. Although the fact that wire center boundaries may split individual CBs suggests that logical NPA-NXX mapping is most appropriate, their are several reasons why Hatfield will use geographical CB-based mapping in addition to an NPA-NXX analysis. The first is that a new data source from Business Location Research (BLR) has become available that provides wire center boundaries down to approximately the CB level. The second is that there can be CBs that lack any NPA-NXX information (either because they are empty or their data are incomplete). Third, complete reliance on NPA-NXXs can be misleading in the presence of FX lines, or customers receiving Centrex or ISDN service from a remote switch.

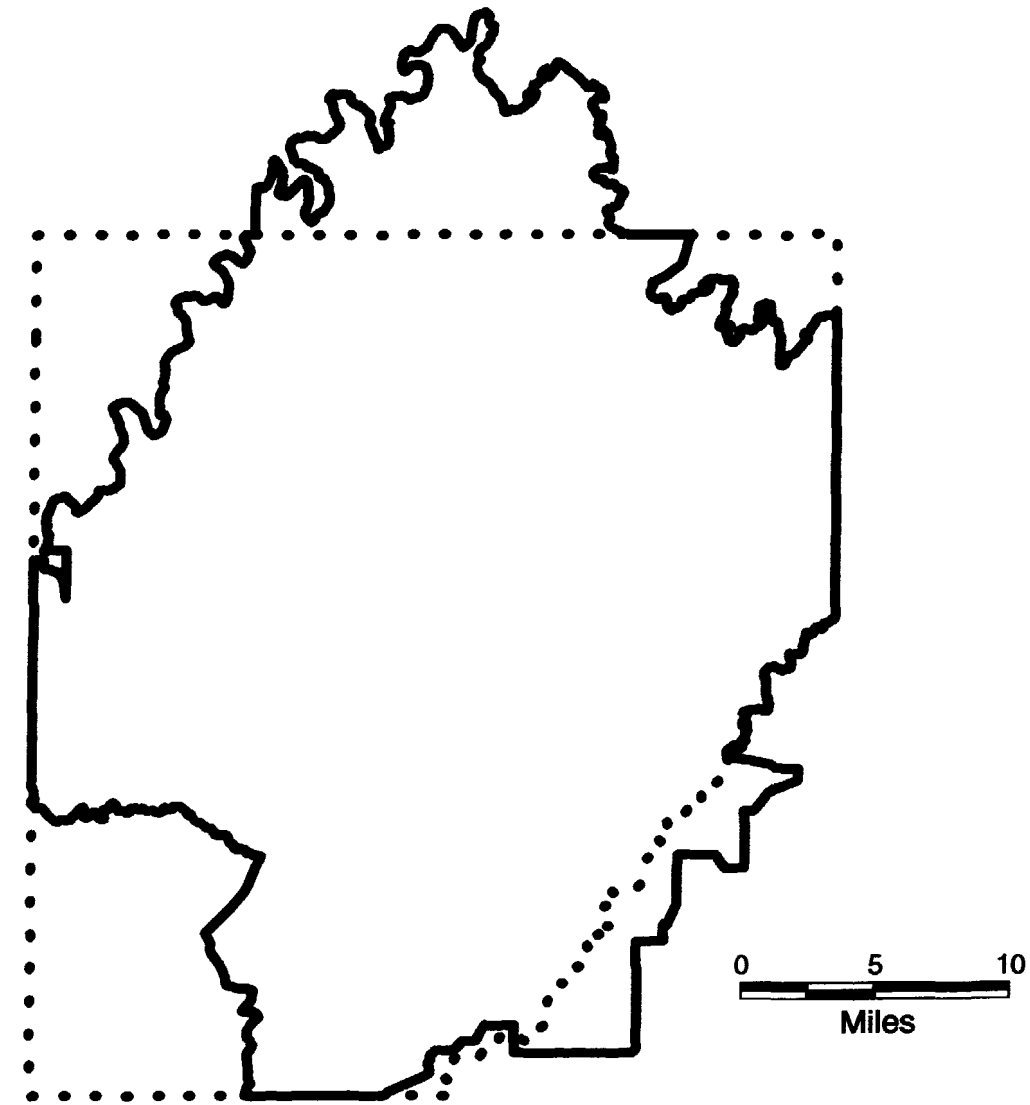
Because the Commission has requested that the models provide comparable analyses for the six wire centers in question, and because the BCPM uses exclusively the BLR data to define its wire center boundaries, for this exercise, Hatfield will use BLR boundaries to define wire center service areas.

The attached charts show both the wire center boundaries as indicated by Release 4.0 of the Hatfield Model, and the wire center boundaries as indicated by BLR that will be used in this six wire center exercise.


Duluth GA
Wire Center Boundary
Comparison
BLR
Hatfield 4.0
0
2.5
5
Miles

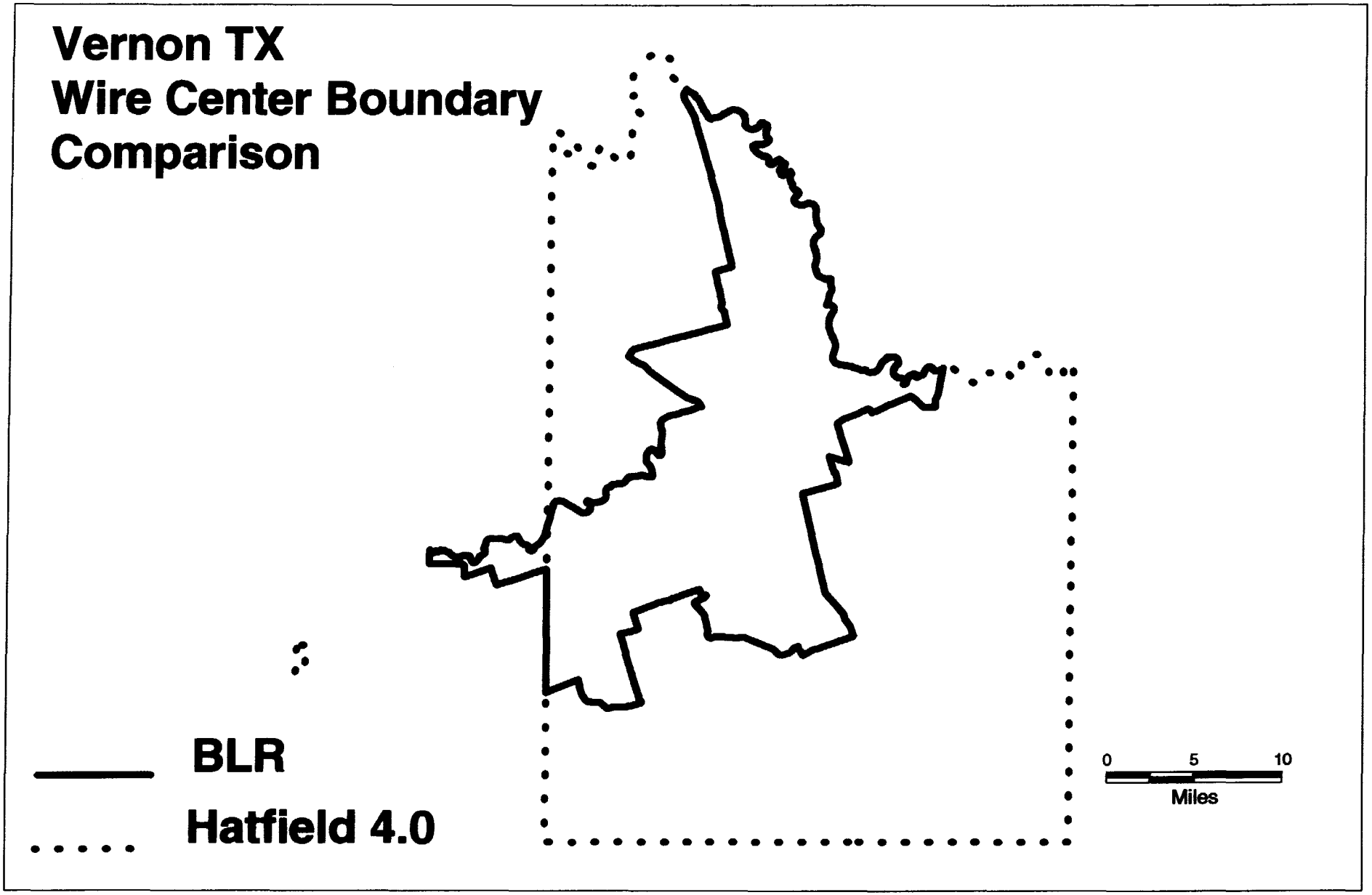

Waynesboro GA
Wire Center Boundary
Comparison
BLR
Hatfield 4.0
0
5
10
Miles

Albany TX
Wire Center Boundary
Comparison

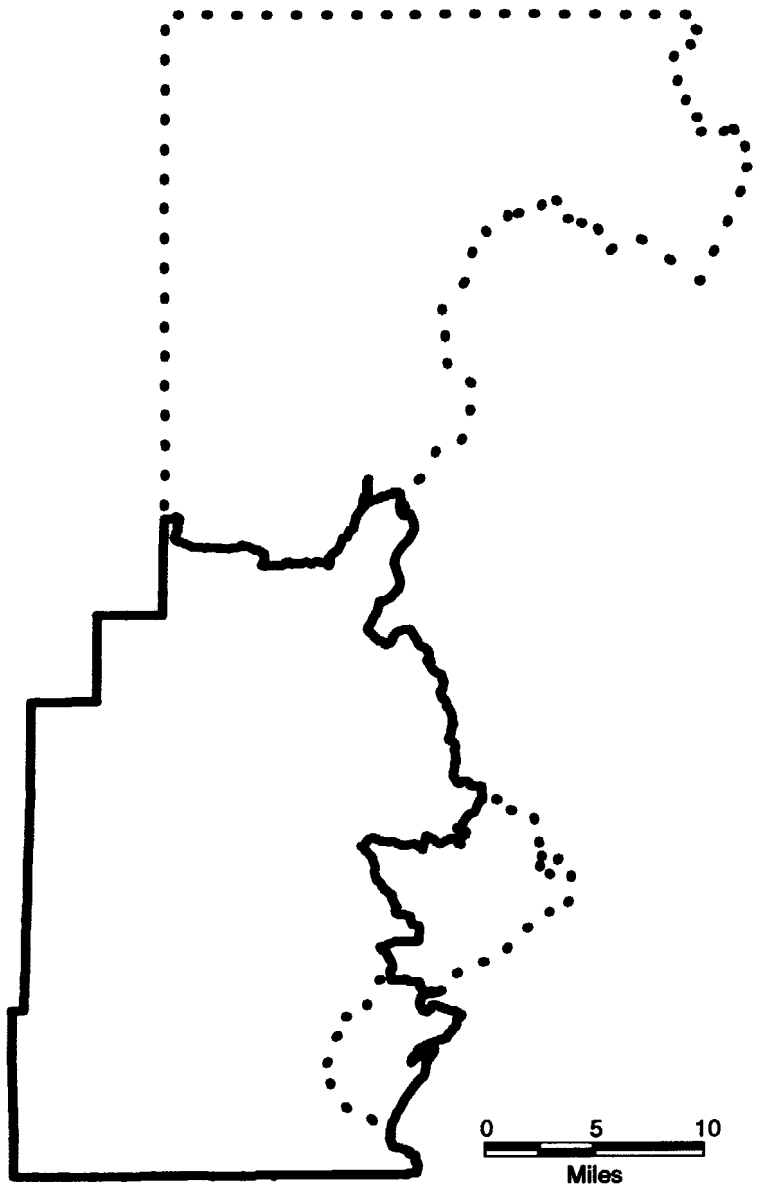


BLR

Hatfield 4.0

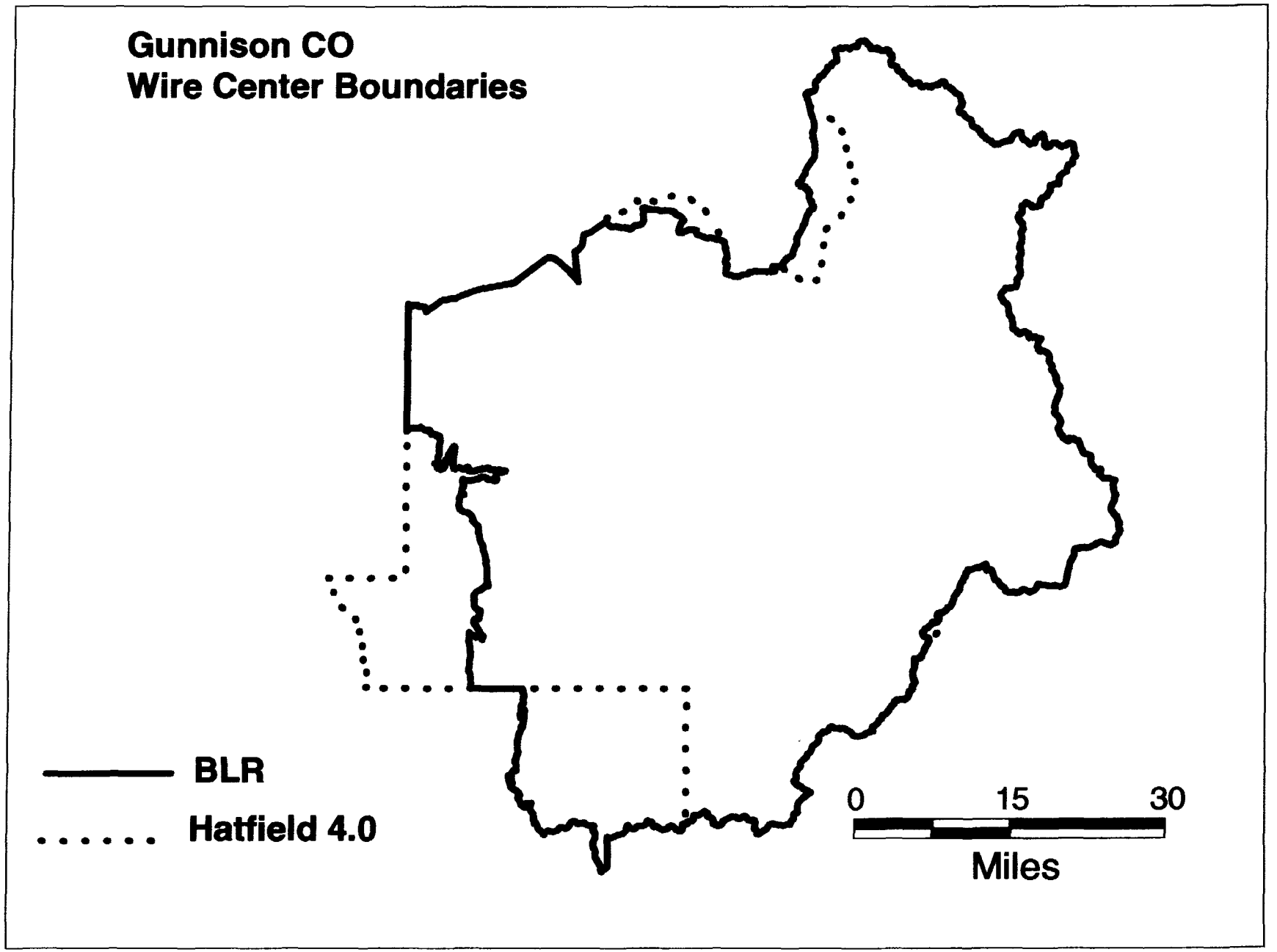

Vernon TX
Wire Center Boundary
Comparison
BLR
Hatfield 4.0
0
5
10
Miles

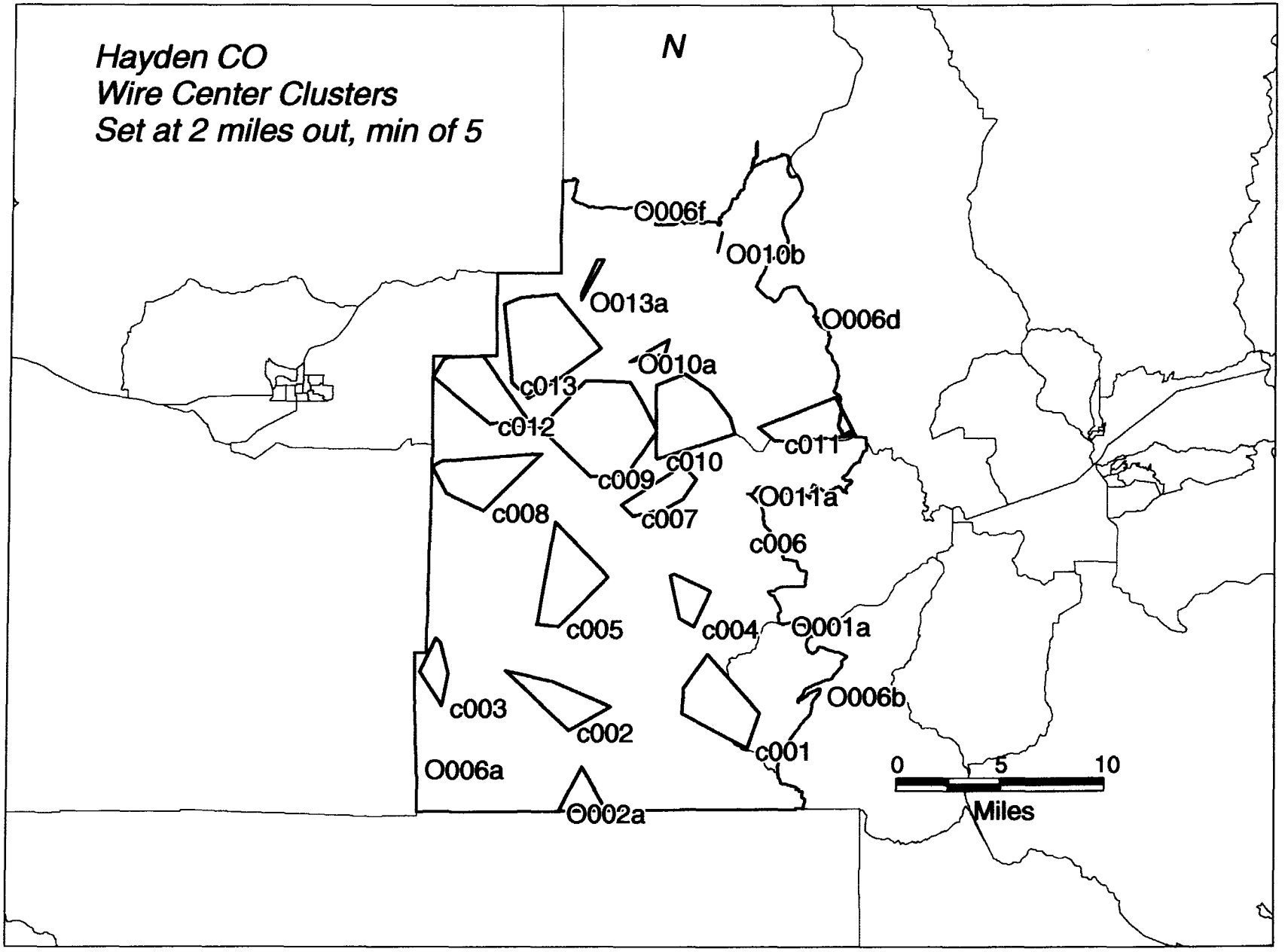
Hayden CO
Wire Center Boundary
Comparison



BLR

Hatfield 4.0


Gunnison CO
Wire Center Boundaries
BLR
Hatfield 4.0
0
15
30
Miles


Hayden CO
Wire Center Clusters
Set at 2 miles out, min of 5
N
O006f
O010b
O013a
O006d
O010a
c013
c012
c011
c010
c009
O011a
c008
c007
c006
c005
c004
O001a
O006b
c003
c002
c001
O006a
O002a
0
5
10
Miles

PNR National Access Line Model Development

(Version 1.0)

The PNR National Access Line Model uses survey information, Bellcore's Local Exchange Routing Guide ("LERG"), the Dun & Bradstreet business database, the Donnelley Marketing household database and Claritas 1995 census estimates to estimate the number of residential and business access lines in each wire center in the United States. This summary describes the methodology, data and assumptions used in constructing the access line model.

The source of the wire center information used in the Wire Center Access Line Model is Bellcore's Local Exchange Routing Guide ("LERG") database dated January 1, 1997. All switching entities (wire centers) in the LERG with Common Language Location Identifier ("CLLI") codes not marked as an end office, host or remote were removed from the wire center database. Also, switching entities that were recognized as being owned by wireless providers, long distance companies or competitive access providers were removed.

I. Assigning Wire Centers to Census Blocks and Census Block Group

All households in the Donnelley DQI[2] database and businesses in the Dun & Bradstreet database were assigned Census Block (CB) and Census Block Group (CBG) geocodes, where possible. The geocodes used were to the specific street address or point location level. Census Blocks (CBs) were assigned to wire centers based on the Donnelley and Dun & Bradstreet data using the following algorithm:

1. For households or businesses with telephone numbers without NPAs (area codes), an NPA was assigned based on the location of the household or business. This situation occurred infrequently and generally only in independent company territory.
2. All households and businesses with telephone numbers were associated with a wire centers -- based on the NPA-NXX of customer's telephone number and the relationships between NPA-NXXs and wire centers that are compiled in the LERG.
3. Exceptions were made for wire centers that were more than 75 miles from the assigned household or business or in a non-neighboring state (for example, a business in California assigned a wire center in New York). These situations occur primarily because of foreign exchange situations.
4. Where there are multiple wire centers associated with a CB, the mode wire center was chosen as the one assumed to serve the CB.

For any yet unassigned CBGs, the following steps were applied in the order shown:

1. If the assignment of wire centers to CBs within a CBG indicates that multiple wire centers serve the CBG, the mode of the CB to wire center assignments (based on total number of households and employees) was used to assign a unique wire center to the overall CBG.
2. If a CBG was still unassigned at this point, it was assigned to the wire center closest to the centroid of the CBG.

In some cases there are wire centers from one state assigned to households and businesses and associated CBs in another state (the case of foreign exchanges). In those instances the following adjustments were made:

1. Assignments were removed for geocoded data not in bordering county.
2. Assignments were removed if these assignments accounted for less than 10% of the assignments for a CB.
3. Assignments were removed if the assigned wire center was far from the CB (for example, in the center of the bordering state).

A final check was then made to ensure that all CBs and CBGs were assigned.

II. Business Access Line Modeling and Estimates

Using business customer survey results, models of business line counts were developed including the probability of these being Centrex lines. The models determined line counts based on SIC code, employment size, region of country and legal status. Model results were used to score each firm in the Dun & Bradstreet database. The total number of business access lines at the study area level (including Centrex) was constrained to equal the number of business access lines reported to the FCC.

1. Firms in the Dun & Bradstreet database were geocoded and assigned CB and CBG codes wherever possible. Geocodes were assigned at the street address or point location level.
2. The number of business access lines were projected using survey data. This model is based upon, among other factors, the self-reported number of businesses lines within a company and by SIC code indicator.
3. Using the CB to wire center correspondence table (see *Section I* for a description of this process), the number of access lines for all identified firms within a CB or CBG were aggregated to obtain an estimate of the total number of business access lines within each CBG and wire center.
4. Apply mapping methods to wirecenter data.

III. Residential Access Line Modeling and Estimates

Using survey results, additional residential line models were estimated as functions of demographic information, local telephone company and state. The number of residential access lines within a CBG was estimated using household count information, second line penetration and telephone penetration. The total number of residential access lines at the state level was constrained to be consistent with the number of residential access lines reported to the FCC.

1. The entire Donnelley DQI[2] database of approximately 95 million households was assigned CB and CBG geocodes, where possible.
2. Second line penetration rates were modeled using a nonparametric regression procedure. The output from this procedure was a multidimensional matrix of second line penetration rates by age, income and by Tier 1 local exchange company by state. Age and income were presented by categories (i.e. income less than $15,000, etc.).
3. This multidimensional matrix of second line penetration rates was projected onto each CBG using information obtained from Claritas and from the 1990 Census. The projections first required estimates of the number of household with telephones. This was computed using data from the 1990 Census that provides the percent of household without telephones. The actual number of households for each CB was obtained by using the 1990 CB household percent composition distributions from the U.S. Census, and proportionally inflating these values until they match the Claritas 1995 CBG subtotals. CBG and CB geographies showing "no households" were compared to actual, postal-deliverable household address subtotal counts for the same area derived from the Donnelley household data, and these data are used where these counts are greater than zero.
4. The models were then aggregated to every CBG in the US.
5. The total number of residential access lines at the study area level is constrained to be consistent with the number of access lines reported in ARMIS to the FCC by companies within each state.

Description of Location Input Data and Geocoding

Metromail Residential Data

The basis for the point locations is provided by Metromail, Inc. The Metromail National Consumer Database© (NCDB) is a large, nationally compiled file of U.S. household-level consumer information that includes both deliverable postal addresses and telephone numbers. The file consists of over 100 million households – which constitute over 90% of the 110 million households that the U.S. Bureau of the Census reported for 1995.

To ensure that the data captured are the most current available, this file is updated 65 times per year, and undergoes numerous "hygiene" measures to ensure its continued high quality for direct marketing purposes. Such purposes require the data to reflect postal address standardization practices, incorporate National Change of Address (NCOA) processing, and permit postal geocoding to street address, ZIP+4 or Carrier Route levels.

The file is compiled primarily from telephone White Pages directory data, but also utilizes many other primary sources of information, such as new mover records, voter registration data, motor vehicle registration information, mail-order respondent records, realty data, and home sales and mortgage transaction information, to build a large repository of verified household-level data.

Dun & Bradstreet Business Data

Dun & Bradstreet collects information on more than 11 million businesses nationwide. Information is gathered from numerous sources such as business principals, public records, industry trade tapes, associations, directories, government records, news sources, trade organizations, and financial institutions. This information is validated each night. Additionally, D&B conducts millions of annual management interviews to help improve the timeliness and accuracy of its information.

The information is organized by D-U-N-S number, a nine digit identification sequence which allows for the placement of companies within larger business entities according to corporate structures and financial relationships. A D&B family tree may be used relate separate operating companies to each other, and to their ultimate parent company. D&B also provides "demographic" information on each of the firms in its database. Such information includes counts of numbers of employees, and well as the SIC code of the establishment.

Geocoding

Geocoding of the households in the Metromail database and of the business establishments in the D&B database is performed using the Centrus Address Coding Modules (ACM) address standardization and geocoding software from Qualitative Marketing Systems.

Since the majority of users of the ACM software have as their purpose the generation of mailing list information, the ACM first standardize all database address records to USPS mailing specifications. Next, the address is geocoded -- either to the address or to the ZIP+4 level. If the address can be located within the ACM's street network files, ACM assigns a latitude and longitude to the point location that is precise to the 6^{th} decimal place. If the address cannot be found in the enhanced street network file, the address' location and census information may be derived from (in decreasing order of accuracy) the address' ZIP+4, ZIP+2, or ZIP Code centroid. Because of the Hatfield Model's need for extremely accurate geocode information, addresses that cannot be geocoded to a precise point location are not currently used to determine customer clustering.

Description of Process to Adjust Geocode Data

Because complete geocode data are not available for every Census Block (CB), the Hatfield Model 5.0 will use several complementary approaches to adjusting the available geocode data so as to maximize the correlation between the actual telephone subscribership in a CB and the subscribership level reflected in the model for that CB.

PNR will first provide geocoded latitude and longitude record for each business and residential customer location that is geocodable in its datasets.

Because there are no more authoritative targets for business line counts at the CBG or CB level than the PNR business input data, this business customer location data will not be adjusted by PNR . Within the access line normalization process the business related demand data will be adjusted to agree with the publicly reported line counts at the study area level.

The adjustment of residential data will be performed using the relationships between 1990 Census data at the CB level, 1995 Claritas projections at the CBG level and current Metromail data at the point level. To obtain 1995 projections at the CB level, existing Claritas data at the CBG will be apportioned down to the CB level using 1990 Census distributions. This "shared down" figure will then be compared against the number of residential customers geocoded to that CB. This figure is identified as the percent of target count that has good geocodes.

If the percent of target variable is less than 50% for a CB, surrogate point location data will be generated. Surrogate points are defined as the difference between the actual geocoded points and the distributed Claritas CB projections The surrogate data will be assumed to be uniformly distributed around the perimeter of the CB. Once placed, surrogate points are considered to be the same as actual points. As such they will be clustered in conjunction with the original geocoded point data.

If the percent of target variable is greater than 50% for a CB, then adjustments for missing data will occur in the downstream model processes. These adjustments will apply to the cluster area data as well as the various demand data. The model process will directly increase the HH and residence line counts in the CBs to account for the data implied as missing by the percent of target variable. For example, if the geocode HH count in the CB is 6, and the percent of target this 6 represents is 60% of the total, then these 6 HHs would be increased by the implied 4 missing HHs to equal a total figure of 10. The cluster areas will also be adjusted by this "gross-up" process. Main cluster areas (denoted by a leading "C") are grossed up by .75 of the difference between the achieved percent of target and 80% (if the achieved percent of target is between 50% and 80%). Outlier cluster (denoted by an "O") and outlier areas are grossed up by 100% of the difference between the achieved percent of target and 80% (if the achieved percent of target is between 50% and 80%). If geocoding achieves over 80% of the target, all additional

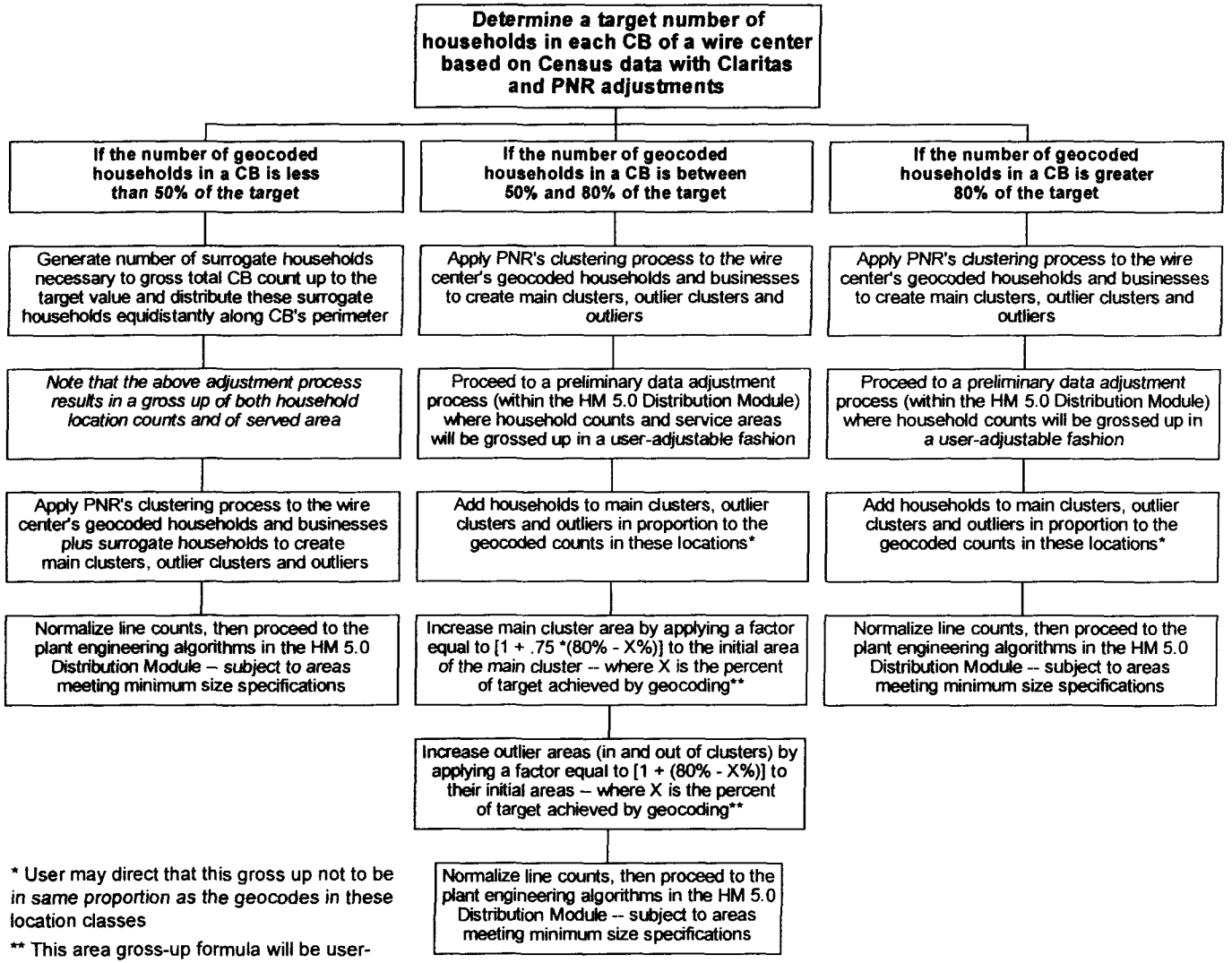
customers will be assumed to be interleaved among geocoded customers, and no area gross ups will be performed. In the final version of the distribution module, all of these gross up parameters will be user defined inputs.

For the six wirecenter trial, the residential and business closing factors (study area specific) from HM 4.0 will be applied to all of the demand data. When the full study areas are run, these factors will be replaced with recomputed closing factors.

The area computation from the geocode process is augmented with a minimum area calculation which is calculated as a function of the number of footprints and a minimum footprint size. The minimum is used if it exceeds the input cluster area.

The attached chart describes the gross up adjustments to geocode data in flow chart format.

GROSS UP ADJUSTMENTS TO GEOCODE DATA



* User may direct that this gross up not to be in same proportion as the geocodes in these location classes

** This area gross-up formula will be user-adjustable

PNR PRODUCT LICENSE AGREEMENT

IMPORTANT--READ CAREFULLY: This PNR PRODUCT LICENSE AGREEMENT ("AGREEMENT") is a legal agreement between you ("USER", either an individual or a single entity) and PNR and Associates, Inc. ("PNR") for the software product identified below, which includes computer code and associated media and printed materials, and may include electronic documentation ("PRODUCT"). By using the PRODUCT in any form, you agree to be bound by the terms of this AGREEMENT. If you do not agree to the terms of this agreement, promptly destroy all electronic and hardcopy components of the PRODUCT, and destroy any copies made on any storage media.

1. **PRODUCT.**
The following items, including all associated hardcopy and interactive documentation, are hereinafter collectively referred to as the "PRODUCT":

- **Software:** The Spatial Clustering™ Module (SCM) -- a text listing of C++ code that performs the localized spatial clustering of any point-geocoded detail data records -- to be used in conjunction with any version of the Hatfield Network Cost Planning Model ("HATFIELD MODEL").
- **Documentation:** Any electronic or hardcopy description of the SCM and/or its function.
- **Media:** Hardcopy, or electronic text files containing the SCM C++ code.

Total PRODUCT LICENSE Fee: **$ No Charge** *(through special arrangement with the FCC)*
The PRODUCT is licensed, not sold. The PRODUCT is protected by copyright and intellectual property laws, and may not be distributed outside of the United States.

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This AGREEMENT grants the USER the following rights, for any electronic versions of the PRODUCT:

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3. **OTHER RIGHTS AND LIMITATIONS.**

- **Limitation on Application.** The PRODUCT may only be used for analyzing the process of spatial clustering of geocoded point data related to the HATFIELD MODEL. No other uses are permitted.
- **Limitations on Copying and Conversion.** USER may not make any copies of the hardcopy components of the PRODUCT, under any circumstances, in any form, nor convert PRODUCT into any electronic format.
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- **Termination.** Without prejudice to any other rights, PNR may terminate this AGREEMENT if USER fails to comply with the terms and conditions of this AGREEMENT. In any event, USER must destroy all copies of the PRODUCT and its component parts.

4. **COPYRIGHT.**
All title and copyrights in and to the PRODUCT, the component parts, and copies of the PRODUCT, are owned by PNR and Associates, Inc. As the PRODUCT is protected by copyright laws, USER must treat the PRODUCT like any other copyrighted material, except that USER may either (a) make one copy of the software component of the PRODUCT solely for backup or archival purposes, or (b) install the software component of the PRODUCT on a single computer, provided that USER keeps the original solely for backup or archival purposes. User may not copy any of the hardcopy materials that are components of the PRODUCT.

5. **INDEMNIFICATION.**
VENDOR represents and warrants that it has title or proprietary rights to license PRODUCT to USER. VENDOR shall defend, indemnify and hold USER harmless from any claim that any part of PRODUCT infringes on any third party, provided that VENDOR is notified promptly by USER of any such claim. VENDOR shall have sole control of the defense with respect to the claim (including settlement of such claim) unless VENDOR agrees otherwise.

6. **LIMITED WARRANTY.**
VENDOR warrants that PRODUCT will perform in accordance with the accompanying written or on-line documentation, and that the media (if supplied by VENDOR) upon which the PRODUCT is provided will be free from defects in materials and workmanship under normal use and service for a period of ninety (90) days from the date of receipt.

7. **LIMITATION OF LIABILITY.**
OTHER THAN AS SPECIFICALLY SET FORTH ABOVE, VENDOR MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR OTHERWISE WITH RESPECT TO PRODUCT, NOR SHALL VENDOR BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES EVEN IF VENDOR HAS BEEN OR IS HEREAFTER ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. In no event shall VENDOR's liability to USER, if any, exceed the amount of payment made by USER to VENDOR.

8. **WAIVERS.**
No failure or delay by VENDOR in enforcing any right or remedy under this AGREEMENT shall be construed as a waiver of any future or other exercise of such right or remedy by VENDOR.

9. **GOVERNING LAW.**
This entire agreement is governed by the laws of the State of Pennsylvania.

10. **GENERAL PROVISIONS.**
Should any provision of this AGREEMENT be held by a tribunal of competent jurisdiction to be contrary to law, the remaining provisions shall remain in full force and effect. This AGREEMENT constitutes the sole and entire understanding between VENDOR and USER concerning PRODUCT, and may not be altered except by a written contract signed by authorized representatives of VENDOR and USER.

11. **USER INQUIRIES.**
Any questions regarding the PRODUCT or this AGREEMENT may be directed in writing to VENDOR's headquarters at: PNR and Associates, Inc.; 101 Greenwood Avenue; Suite 502; Jenkintown, Pennsylvania, 10946.

```
// Excerpt from ClusterDlg.cpp : implementation file
//

void CClusterDlg::OnRun()
{
	// Show run status
	m_Status.ShowWindow(TRUE);
	CStatus Stat(&m_Status);
	Stat.SetText("Setting up run ...");

	// Disable app buttons
	EnableDlg(FALSE);

	// Open the data and output files
	if (!OpenFiles())
	{
		EnableDlg(TRUE);
		return;
	}

	// Write specifications to log file
	m_OutputFile->SaveLog(m_Specs);

	// Allocate
	CDistance* pMatrix = new CDistance();
	CClustComp* pCluster = new CClustComp();

	// Process all of the blocks on the list
	CString str;
	BOOL bDone = FALSE;
	while (!bDone)
	{
		// Initialize member variables based on each Block Group Processed
		Init();
		pMatrix->Empty();
		//pCluster->Init();

		// Read in data
		Stat.SetText("Retrieving data ...");
		bDone = GetData();
```

```
        // Initialize the status bar to reflect current block group
        CString StatLn1 = "Block group ";
        StatLn1 += Stat.GetNumText(m_DataFile->GetNDone());
        StatLn1 += "\r\n";
        Stat.PeekMsg();
        if (!m_bSkip)
        {
              // Initialize cluster
              Stat.SetText(StatLn1, "  Initializing cluster grid ...");
              pCluster->Initialize(m_DataFile, &m_Specs);

              // Cluster split group
              Stat.SetText(StatLn1, "  Calculating clusters ...");
              pCluster->ComputeClusters(&m_Specs, FALSE);

              // Cluster outliers
              Stat.SetText(StatLn1, "  Calculating outlier clusters ...");
              pCluster->ComputeClusters(&m_Specs, TRUE);

              // Allocate member variables based on number of clusters
              Stat.SetText(StatLn1, "  Finalizing cluster solution ...");
              pCluster->Finalize();

              // Save
              Stat.SetText(StatLn1, "Saving output.");
              m_OutputFile->Save(m_DataFile, pCluster);
        }
}

// Deallocate
delete pMatrix;
delete pCluster;

// Clean up
Stat.SetText("Run complete.");
CloseFiles();
EnableDlg(TRUE);

return;
```

```
}


// Area.h : definition of the CArea class

#ifndef AREA__H
#define AREA__H

#define IsClockwise 1                // 1 if Clockwise, -1 if CounterClockwise
#define MaxSlope 1.79e+308
#define MinSlope -1.79e+308

class CArea : public CObject
{
// Construction
public:
      CArea();
      ~CArea();

// Attributes
protected:
      const double* m_X;
      const double* m_Y;
      CUIntArray m_Points;
      CUIntArray m_Perimeter;

// Functions
public:
      double Compute(long n, const double* x, const double* y, const CUIntArray* Outlier = NULL);
      double Compute(const CUIntArray* Cases, const double* x, const double* y, const CUIntArray* Outlier =
NULL);
      void Init();
      void CopyPerimeter(CUIntArray& Perim);

protected:
      double Compute();
      double ComputeArea();
      double ComputeDistance(double x1, double y1, double x2, double y2);
      double ComputeSlope(long Point1, long Point2, long Direction);
```

```
	long GetNextPoint(long CurPoint, long Direction, BOOL &LastXSloped);
	void GetPerimeter();
};

#endif



// Area.cpp : implementation of the CArea class
//

#include "stdafx.h"
#include "Area.h"
#include "math.h"

//////////////////////////////////////////////////////////////////////
// CArea construction/destruction

CArea::CArea()
{
	m_X = NULL;
	m_Y = NULL;
	m_Points.RemoveAll();
	m_Perimeter.RemoveAll();
}

CArea::~CArea()
{
}

//////////////////////////////////////////////////////////////////////
// CArea functions

void CArea::Init()
{
	m_X = NULL;
	m_Y = NULL;
	m_Points.RemoveAll();
	m_Perimeter.RemoveAll();
}
```